ABSTRACT

Accomplishment of this work enabled evaluation of scratch, erosion and abrasion resistance of renewal acrylic-polyester coating systems applied for car bodies painting.
Determination of above resistance characteristics describing coatings mechanical properties, which determine their answer to selected factors of work environment, was the doctoral dissertation main aim.
For this it was necessary to carry multicriteria investigations of properties, characterising acrylic-polyester coatings aged on climatic station for two-year period, as well as accelerated tests in climatic chambers of different type. Ultraviolet radiation, simulating ultraviolet part of Sun radiation which dominates in the destruction process of polymer coatings, is the main ageing factor in accelerated tests. The following properties were adopted as evaluation criteria of the state of examined coating systems surface, concerning mainly to the acrylic top coats: water wetting angle, free surface energy, surface topography and roughness, surface destruction degree and kind as well as gloss and colour. On the other hand, to the evaluation of whole acrylic-polyester coating system (applied on the steel substrate) the following criteria were applied: hardness (acc. Buchholz, pencil), resistance of adhesive joint between the coating and the substrate, coating adhesiveness (determined using scratch test method), abrasive and erosive resistance as well as scratch resistance. Obtained test results proved that long lasting influence of climatic factors and environmental pollutants destructs whole coating system. This causes in effect a reduction of adhesive joint resistance between the base coating and the substrate, which determines the coating protective properties. However, ultraviolet radiation influence caused destruction of superficial layers first of all, contributing to the original colour and gloss loss which biased their decorative properties decrease. What more, it was determined that the kind of used pigmentation had an essential influence on properties of acrylic-polyester coating system as the systems with the red interlayer showed higher resistance to the influence of climatic factors and an environment contamination than the coating systems with the blue interlayer. It was caused mainly by differences in pigment grain sizes. The red pigment consisted of iron trioxide nanoparticles which more effectively sealed a swell as strengthened the interlayer structure than microparticles of sodium aluminosilicates which stained coating blue.
Investigation results presented in the work increase the collection of information concerning the quality of car bodies' renewal coatings. Moreover, the developed investigation methodics can serve for quality evaluation of new generation nanocoatings which formulae change every five years in average for last ten years. In this context it is therefore pressingly expected to carry accelerated investigations during the period of lasting considerably shorter than five years and simulating different conditions of car bodies' use. The dissertation meets this expectation.

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